

**Docket #:** S23-010

# **Multi-layer self-healing devices using immiscible dynamic polymers**

Researchers at Stanford University have developed a multilayered immiscible polymer system capable of autonomously realigning its layers to enhance the healing process after damage. Self-healing polymers, which can recover from various forms of damage, often include conductive or dielectric particles for added functionality and are typically arranged in a multilayer configuration. While these polymers usually self-heal effectively when layers are aligned, misalignment can significantly reduce healing efficacy. To address this, Stanford researchers created a laminate with immiscible dynamic polymers, each with the same dynamic bond for strong interlayer adhesion but different backbones for interfacial tension-mediated realignment. This design ensures complete self-directed structural and functional recovery after damage.

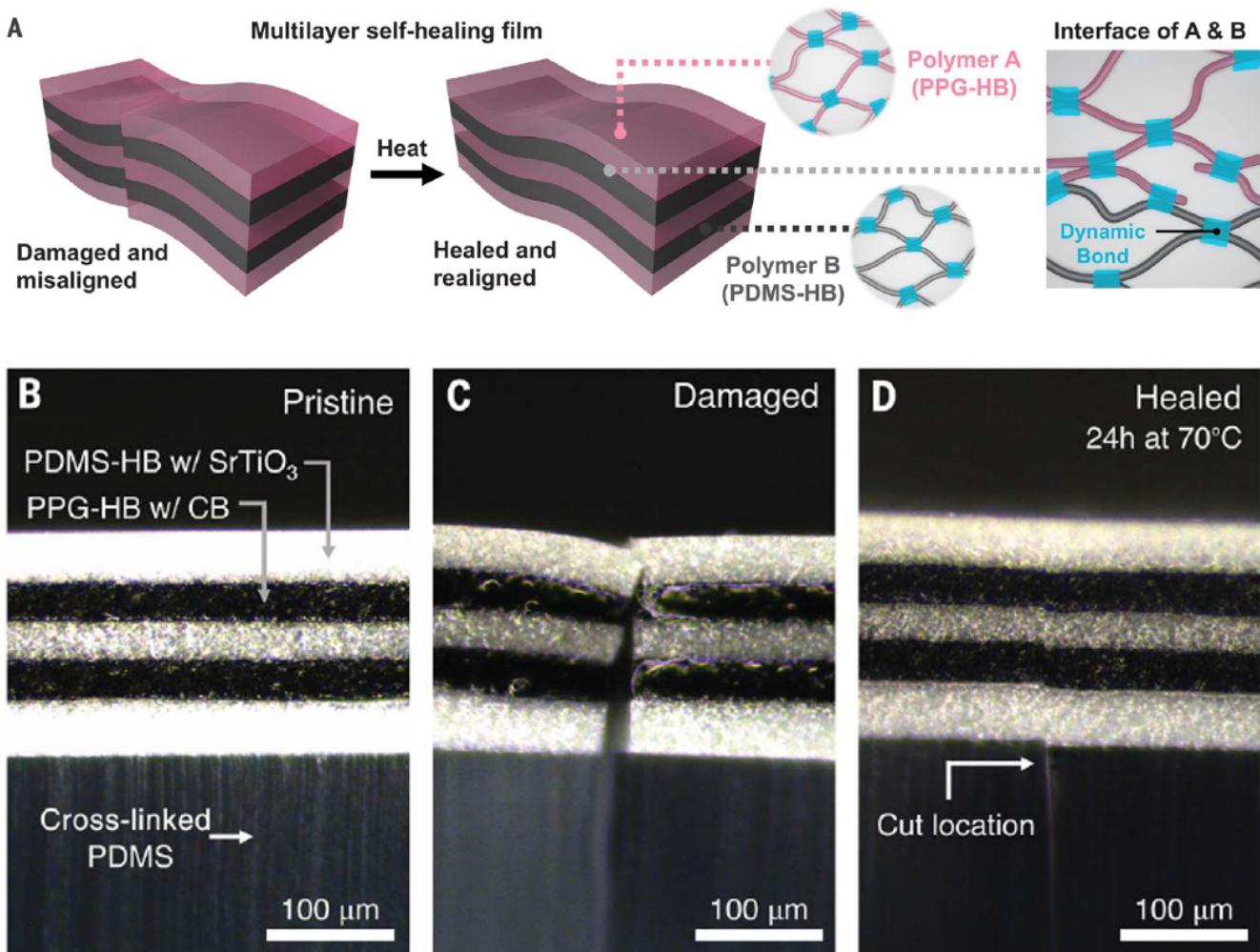


Figure 1. A) Schematic showing the principle of surface tension-mediated realignment and healing of a fractured multilayer laminate. B) Before damage, C) after damage, and D) after healing (Adapted from Figure 1 and 4 in Cooper *et al.* (2023)).

## Stage of Development

Proof of concept

## Applications

- Soft robotics
- Surgical modeling
- Films and coatings for industrial uses
- Implantable flexible electronics
- Wearable flexible electronics

## Advantages

- Less risk of misalignment and functional loss
- Can incorporate multiple functions
- Inspired by the human skin healing process
- Potential for countless applications with other immiscible polymers

## Publications

- Cooper, C. B., Root, S. E., et al. (2023). [Autonomous alignment and healing in multilayer soft electronics using immiscible dynamic polymers](#). *Science*, 380(6648), 935–941.

## Innovators

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